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XL.—*On the Primrose-leaf Miner; with notice of a proposed new Genus, and characters of three Species of* Diptera. By Mr. James Hardy*.

The Primrose is perhaps the most popular of our native plants, associated as it is with bright skies, the song of birds, and spring-tide anticipations. What youthful bard has not attuned his lyre to the inspiration of the pale features of

> "The ae flower, the ae first flower,
> Springs either on moor or dale?"

and grave and reverend sages have written, experimented and surmised, till the poor flower may be said to be put fairly out of countenance. But although thus a theme of general regard, and one in which most, simple or sage, at one time or another have been interested, there is one portion of its history as yet unassayed, or if touched, still left in conjecture and obscurity. I allude to the curious and beautiful appearances, that every close observer must have remarked, which many of the leaves of the plant put on, long after the frail blossom that first drew willing eyes has withered and passed away, and which still preserve for it a claim on more than passing attention. On picking up one of the leaves, sometimes the middle part of the upper surface will be found of nearly a pure white, which, where it is limited by the original green, presents a wavy and exceedingly fantastic outline; at other times small undulating bands issue from the colourless central area, like streams

> "Devolving from their parent lakes:"

at times we have before us the representation of a serpent untwisting its many coils, and at others a congeries of minute worms, inextricably intertwined, of which we can trace a general

* Read before the Berwickshire Naturalists' Club, at their Meeting of the 17th October 1849.

source, but whose terminations are quite a maze. On turning up the underside of the leaf, however, none of these appearances are perceptible; the tint being of a uniform green. On holding it up to the light, we see in the interior a number of dark specks placed at widish intervals, generally following the several windings, and like so many guide-posts stationed to indicate a thoroughfare through the intricacies. Here then are characters of no ordinary kind, tastefully designed, and evincing lengthened operation; how shall we decipher the legend? and by whom, and with what intention was it inscribed? What a strange tale superstition unfolds respecting these mysteries! June 1825. "In some parts of Dorsetshire and Devonshire a species of blight or grub * has settled on the blackberry [bramble] leaves, gnawing them in a serpentine manner, so that the dead fibre shows through the remaining green. This circumstance has produced, in consequence of a certain prophecy, a great degree of alarm in the minds of the lower classes residing on the borders of Dorset and Devon. It has gone forth that a 'flying serpent' will poison the air, which, becoming impure, will cause the death of nineteen out of twenty; and that the time will be known by this particular appearance on the leaves, which the pseudo-prophet calls the reflection of the serpent. The serpent whose pestilential influence is to be felt, is Satan, whose period of bondage is expired. The deaths will take place principally among persons under thirty years of age. Hundreds of individuals have paid for charms to secure themselves from danger and infection." (Annual Register for 1825, Chronicle, p. 89.) But from the ravings of folly, let us now turn to the explications of fact. In Rennie's interesting little work on 'Insect Architecture,' vol. i. p. 223, 2nd ed., there is a short account of this phænomenon, with a representation of one of its variable configurations. It is there ascribed to the work of a mining caterpillar, which excavates the pulp from beneath those parts of the upper membrane of the leaf, which are left colourless. The small granular bodies already referred to are its ejectamenta, and they follow, although the author rather denies this, the track the miner has taken during its labours. This is so far correct; but from the connexion of the statement,—the mining caterpillars of small Lepidoptera being treated of, and the use of the word "Caterpillar,"—one would infer, that the author imagined that it belonged to some minute moth; and such, till I recently had an opportunity of investigating the subject, I always understood was the meaning implied. But this is a mistake, for the little miner is the maggot or larva of a small, black, two-winged fly belonging to the genus

* This is occasioned by the caterpillar of a minute moth.

Phytomyza of Meigen, of which many of the species in their early stage are known to feed on the parenchyma of leaves. Having traced its states as larva, pupa, and at length a perfect fly, I have been enabled to ascertain the characters of each; and these, as I am not aware of the field being pre-occupied, I shall proceed to detail; and although description is often a barren region to travel through, some interesting features of its œconomy will occur at intervals to lighten the footsteps and reward perseverance.

The *larva* is minute, of a pale glassy green, with the interior darker from the colour of its food; it gradually tapers away behind and is truncate at the tip, but widens towards the front, and is then rather suddenly brought to a point; the segments are regular, distinct, the edges rather elevated, crenulate; about four or five of the anterior ones are protuberant on the sides, the third being the most prominent; the first is provided with two bent black oral hooks, which unite interiorly with an apparatus connected with the muscles which put them in play; [the two fore spiracles have been omitted to be noticed, but they are probably, as in other species, situated behind the head, above;] the posterior end is shaped like the stern of a boat, and is furnished above with two projecting, white spiracular processes, which are barbed like fish-hooks; the anus is a slit at the tip, between two tubercles. Length $\frac{3}{4}$ line. It is by means of the hard oral mechanism that it executes its pretty workmanship, which it does, while lying like a true miner, on one of its sides, by a rapid and continuous rasping or "raking" of the green matter indispensable to it as food. I have not ascertained when it first commences its proceedings, but on the 13th of August I could only detect a single specimen in the larva state. Usually a leaf is tenanted by only a single occupant; but there are instances when two have obtained possession, and then the space from which the colour is discharged is proportionally enlarged, and the convolutions are considerably more tortuous. Upon arriving at a condition suitable to a change of state, which depends greatly upon the quantity and quality of the food that remains to be supplied, the larva leaves the side of the leaf to which it has hitherto been confined, cuts through the pulpy part of the inferior membrane, till it has reached the lower cuticle, through which it thrusts the tips of its posterior spiracles as well as those of its head, and in this position becomes converted into a small light-coloured pupa, the case being formed of the indurated skin of the larva. It has the instinct almost invariably to fix itself alongside of the midrib or one of the secondary fibres; perhaps being induced to this by the obstacles they present to its progress in mining; and the case being covered with the thin

hairy integument of the leaf, is so like a portion of its substance, as sometimes to elude even a very close inspection. The *pupa* is of a light yellow or straw colour, with the seams of the segments brownish, and sometimes it is entirely light brown; slipper-shaped, being rather tapered behind, a little swollen before the middle, conic and somewhat abruptly contracted anteriorly, where the edges of each of the wider segments overlap the one immediately preceding it; smooth; convex above, although sometimes rather compressed, suddenly sloping down in front; segments very distinct, considerably convex, the division lines crenulate, scarcely continuous across the flattish underside, being indicated by transverse punctures and abbreviated lines; the brown sharp-pointed fore-end projects a little beyond the line of the under surface of the body, and is tipped with two longish slender bent black spines, which approximate at their origin, but diverge outwardly; these, in perfect specimens, have at their apices an armature like a fish-hook, both the barbs being reverted; beneath these on the under surface there is a brown or rufous spot; the last segment posteriorly has a channel down the middle with two ridges to bound it, and externally to these two corresponding depressions; the apex is stern-shaped or subtriangular, with two long projecting points, one on each side, above; each of which has a black spinous point, near the base of which a sharpened barb branches out, directed towards the upper surface of the body; the apex is a tubercle halved by a fissure. Length $\frac{3}{4}$ line. The object of the barbed hooks with which the fore and hinder spiracles are accessorily provided, and which are more distinct in this than in any other species I have observed, seems to be to insure the pupa-case from being separated from the leaf by ordinary accidents. The hooks invariably project beyond the cuticle, and are often snapped asunder and left behind in attempts to disengage the pupa-case. On the eve of assuming its final condition a breach is made in the case towards the anterior part, through which the imprisoned inmate obtains access to the open air; destitute of wings at first, but soon equipped with these appendages, that enable it to pursue its destinies under a new and higher degree of development. The *fly*, whose early life and ultimate *début* we have thus traced, presents the following characters:—Black; face black, but when alive gray in some lights, with a deeper shade of black round the eyes and down the face; front black, its edges gray, with a row on each of black bristle-bearing dots; vertex also bristled; a grayish patch above the antennæ, which as well as the bristle are black; third joint large, circular, flattened, finely griseous downy; trunk white, palpi black; thorax subquadrate, considerably convex, and as well as the scutellum slaty black, with several lines of black bristles along

its surface, and two long ones at the apex of the scutellum; abdomen shining black, its hairs also black, the hinder edges of its segments narrowly lighter or subcinereous; a white band along each side when alive; beneath with a black, gradually widening band down the belly, composed of a series of shining black spots set in a whitish edging, the first square, the succeeding parallelogrammic, the last sinuated on the hinder edge, anal segment black; legs black, tip of the anterior thighs whitish, in the other pairs less distinctly paler; poisers white; wings nearly hyaline, with fine iridescent tints of purple, blue, green, orange and brown; their insertion whitish; the costal cell has a cross nerve, and is inclosed by two short curved nervures, the upper very faint, the lower strong and black: there are five longitudinal nervures, of which the two upper are strongest, and a faint sixth or anal one that does not reach the lower edge of the wing; the third has a small cross nerve betwixt it and the second before the junction of the latter with the first, and is united with the fourth by a small transverse line near the base of the wing; the fifth springs from the root of the wing and unites with the sixth by an arched cross line that runs to the short stronger one that combines the third and fourth. Length $\frac{3}{4}$–1 line. Expansion of the wings 2 lines. The female is the larger, and has the abdomen ovate and sharp at the tip; that of the male is more cylindric, with the apex obtuse. When dried the white lateral lines of the abdomen are generally obliterated, and the belly and upper surface become of a uniform black. The first of these flies appeared on the 15th of August, the day on which I gathered the pupæ; others came out on the 27th, and again on September 3rd. The earliest period at which I have taken them in the woods was in the beginning of April, when they frequented the trunks of some recently felled birch-trees to feast upon the sap. The larva is infested by a small parasitic *Ichneumon* that attacks several other species, and must considerably diminish their numbers; those that become pupæ late in the season being almost as likely to produce parasites as flies.

The fly belongs to the Acalypterate division of the Muscidæ, and owing to the comparative imperfection of its organization is placed near the termination of the series. Its position in the arrangement is with the Heteromyzidæ: in the present instance, however, the nervures of the wings present an exceptional character; the mediastine nerve being double, and not simple, as it is said to be in this family. The species appears to be the *Phytomyza nigra* of Meigen, Europ. Zweif. Insekt. vi. 191, which he designates briefly as "nigra; thorace cinerascente; halteribus genubusque albis; alis hyalinis." The only doubt as to this, arises from another species occurring, which, as a fly, it is almost

impossible to separate from the present, but which, in its pupa state, is very distinct; and the mode of mining adopted by the larva supplies another diversity. It is probably the *Ph. obscurella* of Fallen (Phytomyz. iv. 8), which is characterized in nearly the same terms: "nigricans; proboscide halteribusque albis; tibiis genubusve subpallidis." Mr. Haliday bred *Ph. obscurella* from the holly (Ent. Mag. iv. 147), and I obtained my specimens from pupæ inclosed in the leaf of a honeysuckle, growing in the shade of that tree. In addition, I may remark, that a species supposed to be *Ph. nigra* was procured by Mr. Curtis (Brit. Ent. fol. 393) from pupæ found by a lady under the leaves of the columbine; and that Rennie observes that the leaves of the polyanthus are occasionally affected in a manner similar to those of the primrose.

From the examination of several species of these miners in their various states, I have been led to perceive that there are at least two generic forms included under the term *Phytomyza*, and which, although I do not find any tangible distinctive character in the perfect insects, I propose to separate on account of differences in the pupa state, accompanied by a corresponding variation in habit. To those with slipper-shaped pupæ, whose transformations take place entirely within the leaf, I propose to apply the name *Chromatomyia* (*χρῶμα, color*; *μυῖα, musca*); while the name *Phytomyza* may be retained for the species whose pupæ are barrel-shaped, and whose larvæ enter the ground to pass the period antecedent to their final change. The larva of one species, *Ph. lateralis*, is said to live and undergo its mutations in the interior of the heads of *Pyrethrum inodorum* (Curt. Brit. Ent. fol. 393); but whether this departure from the general habit is attended with a change of structure we are not informed. The species, whose complete history has been ascertained, stand as follows:—

CHROMATOMYIA, *Hardy MSS.*

1. *Ch. flaviceps.* Phytomyza flaviceps, *Macq. Dipt.* (*S. à Buffon*) ii. 616. Larva subcutaneous in the leaves of the honeysuckle.

2. *Ch. nigra.* Phytomyza nigra, *Meig.* vi. 191. Larva found in the leaves of the primrose.

3. *Ch. obscurella.* Ph. obscurella, *Fall., Meig.* vi. 191. Larva lives in shapeless blotches in the leaves of the honeysuckle.

4. *Ch. cinereofrons*, Hardy MSS. Nigro-cinerea; hypostomate albo-infuscato; proboscide albida; fronte cinerea; marginibus oculorum punctis nigris notatis; palpis, antennis, punctoque verticis nigris; thorace scutelloque cinereis, opacis; abdomine griseo-nigricante, nitido; margine postico segmenti penultimi

arcte subalbido; vitta laterali parva albo-flavescente; ventre, plaga minime interrupta gradatim laxata nigra nitida, instructo; pedibus nigris, genubus strictius albidis; halteribus albis; alis hyalinis, ad bases exalbidis, nervo transverso singulo. Long. corp. lin. $\frac{3}{4}$.

This is nearly allied to the next. The larva mines the leaves of barley. Two examples of the fly have been obtained.

5. *Ch. Syngenesiæ*, Hardy MSS. Nigro-cinerea; hypostomate proboscideque albis; fronte albo-flavescente; marginum ocularum punctorum serie, puncto verticis, antennis palpisque nigris; dorso thoracis, cumque scutello, cinereis, opacis, lateribus autem cinereo-nigricantibus; abdomine grisco-nigricante, marginibus posticis segmentorum quatuor primorum, anguste, quinti paulo amplius exalbidis; vitta laterali late alba; ventre nitido, incisuris albis, medio, plaga longitudinali macularum nigrarum, ornato, quarum prima quadrata, reliquæ parallelogrammicæ, margine postico quintæ interdum circulatim sinuato; segmento ultimo toto nigro; pedibus nigris, genubus albidis; halteribus albis; alis hyalinis, ad bases exalbidis, nervo transverso singulo. Long. corp. lin. $\frac{3}{4}$–1.

The larva subsists within the leaves of the groundsel (*Senecio vulgaris*), of the ragwort (*S. Jacobæa*), of the field-thistle (*Cnicus arvensis*), and of the sow-thistle (*Sonchus oleraceus*). The winding galleries which it traces in such an elegant manner round the edges of the leaves of the smooth-leaved maritime variety of the plant last-mentioned, appear to be represented in the 'History of Insects,' i. 298. fig. 1 (Family Library, no. 7); but the figure scarcely gives any idea of their exceeding neatness. I have it likewise from leaves of *Cineraria*, sent from Linlithgowshire. The size is constant, which will separate it from the next, said to be $1\frac{1}{2}$ line long; and the colouring of the head, halteres, &c. appears to be much fainter than in *Ch. nigricornis*.

6. *Ch. nigricornis*. Ph. nigricornis, *Macq. Dipt.* (*S. à B.*) ii. 618. Larva lives in the interior of the leaves of cinerarias and turnips. *Curt. Gard. Chron.* Feb. 22, 1845, p. 117.

7. *Ch.*? *Ilicis*. Ph. Ilicis, *Curt. Gard. Chron.* July 4, 1846, p. 444. Larva found beneath the leaves of the holly. *Curt. l. c.*

I have likewise obtained the pupæ of a species from the leaves of *Holcus lanatus*, but they proved abortive; and I have others from the leaves of the holly, from which the fly has not yet proceeded.

PHYTOMYZA, *Fallen, Meig.*

1. *Ph. flava*, Fall., Meig. vi. 196. Larva a miner of the leaves of the buttercup (*Ranunculus repens*), of the bachelor's buttons

(*R. acris, flore pleno albo*), and of the lesser spearwort (*R. Flammula*). Found by Mr. E. Doubleday in the leaves of the hart's-tongue (*Scolopendrium vulgare*). *Ent. Mag.* iii. 414, 415.

2. *Ph. albiceps*, Meig. vi. 194. Larva subcutaneous in the leaves of the cow-parsnep (*Heracleum Sphondylium*), and the field-thistle (*Cnicus arvensis*). Pupa-case black.

3. *Ph. Aquilegiæ*, Hardy MSS. Nigricans; hypostomate sordide subflavo, proboscide alba; fronte flava; antennis palpisque nigris; thorace brevi, subrotundato, convexo, nigro-grisescente, subnitido, lineis dorsalibus longitudinalibus duabus obscuris ægre distinguendis, adumbrato; scutello concolore; abdomine griseo-nigricante, nitido, incisuris interdum stricte albescentibus; vitta laterali parva alba; ventre nigro; pedibus nigris, genubus perobscurius pallidis; halteribus albis; alis hyalinis, ad bases exalbidis, nervo transverso singulo. Long. corp. prope lin. 1.

The larva forms blotches in the leaves of the common columbine (*Aquilegia vulgaris*). It is closely allied to *Ph. albiceps*, but is darker, with the thorax shorter and rounder, and the white dashes before the wings not developed. The pupa-case is brown.

To these may be added others whose changes are still incomplete, found within the leaves of the bean (*Vicia Faba*), the burdock (*Arctium Lappa*), the field-thistle (*Cnicus arvensis*), the wild angelica (*Angelica sylvestris*), the red clover (*Trifolium pratense*), the red hemp nettle (*Galeopsis Tetrahit*), the climbing buckwheat (*Polygonum Convolvulus*), the quicken (*Triticum repens*), the meadow-sweet (*Spiræa Ulmaria*), and the kidney-vetch (*Anthyllis vulneraria*).

Penmanshiel, by Cockburnspath, Oct. 13, 1849.

XLI.—*On the Classification of some British Fossil Crustacea, with Notices of new Forms in the University Collection at Cambridge.* By Frederick M'Coy, Professor of Geology and Mineralogy in Queen's College, Belfast.

[Continued from p. 335.]

Ord. Edriophthalma.

(Trib. *Isopoda*.)

Archæoniscus Brodiei (M. Edw.).

As this interesting Wealden Crustacean (first I believe taken for an oolitic Trilobite) has not yet been fully described, the following notice may be acceptable :—